



# Wright Brothers 1900 Glider

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The Wright Brothers' 1900 aircraft was flown repeatedly at Kitty Hawk, North Carolina, during the fall of 1900, mostly as a kite but also as a piloted glider.

The brothers' main concern at this time was to learn how to control the forces on an aircraft. Others who had thought it was more important to fly first and figure out control later had died in crashes. The Wright Brothers used this aircraft to learn the fundamentals of aerodynamics.

The brothers had observed soaring birds twist their wings to change direction and had successfully done the same thing, which they called "wing-warping," in 1899 by twisting the wings of a small kite. In 1900, the brothers decided to test wing-warping on an aircraft that was large enough to carry a person. The pilot could control the roll of the aircraft by using a foot pedal. The pedal was connected to wires that pulled on the wing tips and warped (or twisted) the wing, producing unequal forces on the wings, which would roll the aircraft.

The 1900 aircraft was relatively large: it had a 17-foot wingspan, a 5-foot chord, and 4 feet between the wings. Without the pilot, the 1900 craft weighed about 50 pounds. In 1900, glider pilots usually flew in a vertical position. The Wright Brothers correctly understood that this produced a lot of aerodynamic drag that would slow the glider down. They chose instead to streamline their aircraft by having the pilot lie horizontally on the lower wing. The aircraft had two wings covered by tightly woven sateen fabric, a stabilizer mounted on the front of the aircraft, and no tail.

All aircraft wings have a natural tendency to flip tail over nose because of the pressure distribution around the wing. To prevent their aircraft from flipping, the Wright Brothers attached a horizontal stabilizer (called a "canard," after the French word for "duck") to the front of the aircraft. On later models the shape of the stabilizer was varied by the pilot to provide pitch (up and down) control. But on the 1900 aircraft, they fixed the stabilizer in place and just tested the wing-warping. They found it too confusing at this time to prove both pitch and roll control.



For 3 weeks, the winds were so light that they flew their craft only as a kite, using chain to simulate the weight of a pilot and operating the controls by cable from the ground. On their final day the winds grew strong, so they decided to test the craft as a glider, with Wilbur as pilot. Launching from a dune hill, he made about a dozen glides, some lasting as much as 20 seconds and covering up to 400 feet, longer than a football field! Even though this was the only day of the season with winds strong enough to carry a pilot, the flights showed that wing-warping was a success. Lessons learned on the 1900 aircraft were incorporated into all of the later Wright aircraft.





# Wright Brothers 1900 Glider Model Instructions

## Designed by

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## Materials

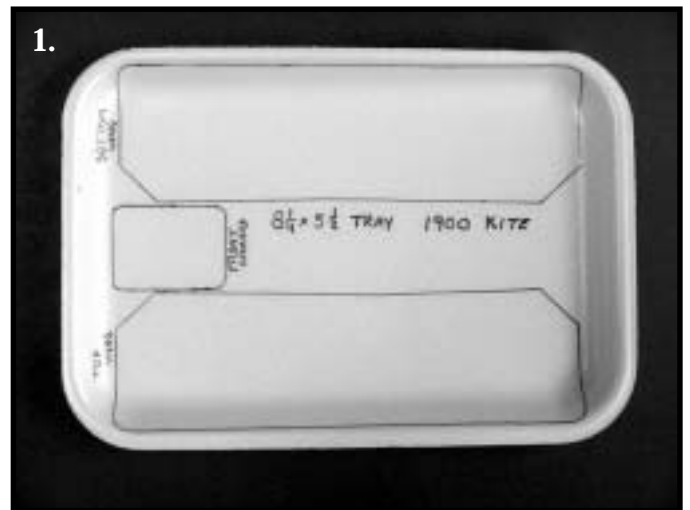
- One or two clean Styrofoam meat trays, at least 8.5 inches (21.5 centimeters) by 5.5 inches (14 centimeters), preferably white
- 30 to 35 toothpicks
- Low-temperature glue gun
- Scissors
- Hobby knife, razor utility knife, or single-edge razor blade (adult help here)
- Cardboard or board to cut on
- Ultrafine-tip black marker
- Ruler
- Emery board
- Manila file folder
- Small plastic toy army soldiers, about 2 inches (5 centimeters) tall (optional)

## General Instructions

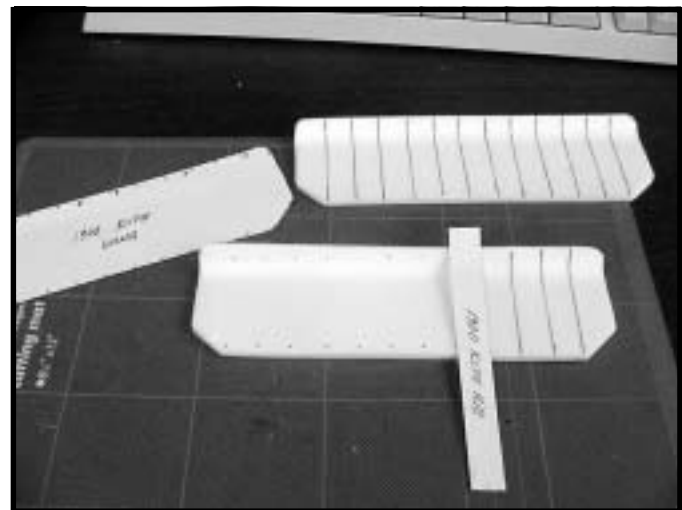
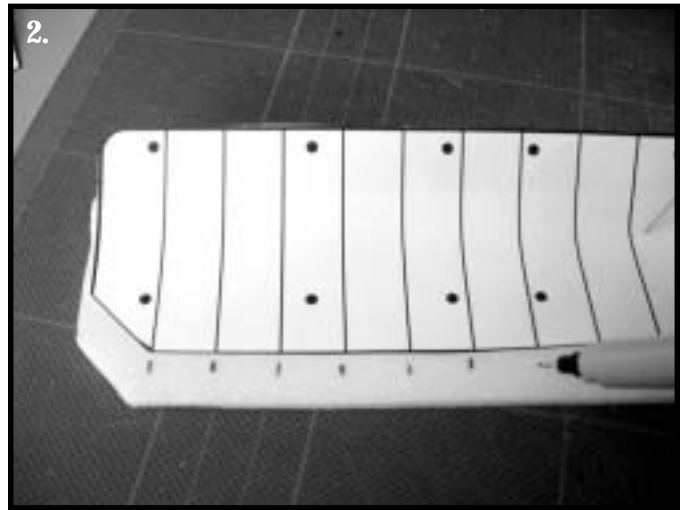
- Use scissors to cut out all three templates on the heavy lines of the 1900 Glider template (found in the back of this book).
- Do all hobby knife or razor blade cutting on the board or cardboard to protect your working surface.
- The finished model is for display only; it is not meant to fly.

## Procedure

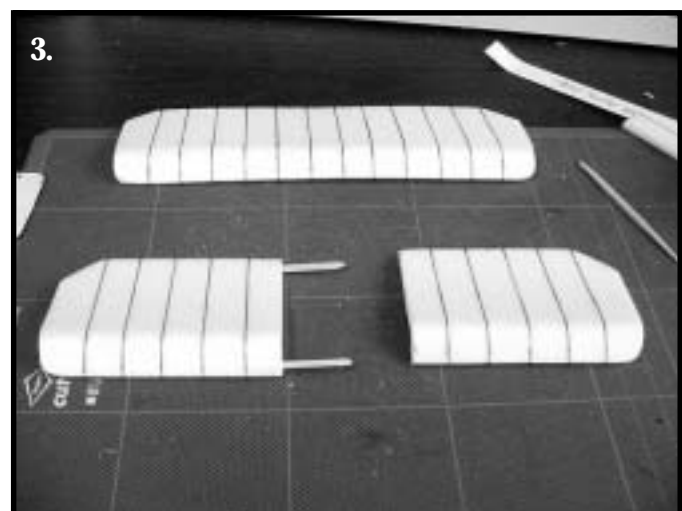
1. Carefully trace the wing and elevator shapes on the inside of the Styrofoam tray as shown. Be sure the front edges of the wings go about two-thirds of the way up the curved sides of the tray. Check the bottom of the tray and avoid any logo found there. You may need two trays. Cut out the wings and elevator with the hobby knife or scissors. Use the emery board to smooth the cut edges and sand off the pen lines.



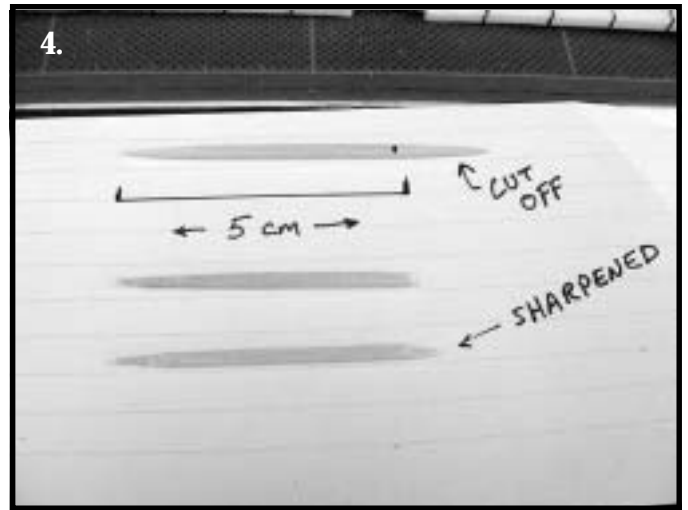
2. Using the templates as a guide, mark the locations of the rib lines on the tops and bottoms of the wing and elevator sections with the ultrafine-tip black marker. Make two sets of marks, one on each edge. Connect the marks to make the rib lines. Make a rib template from a manila folder to draw the rib lines (so the end of the template can be bent to conform to the rounded shape of the Styrofoam).



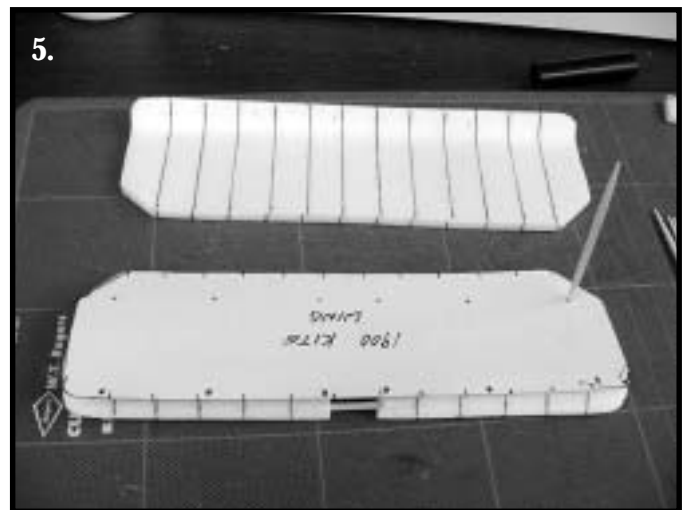
3. Cut out the center of the lower wing only as shown by the dotted lines on that template. Cut a toothpick in half and sharpen the cut ends. Dip the ends in glue and stick them in the cut edges to join the lower wing halves, leaving a .6-inch (1.5-centimeter) gap between the halves. (If the Styrofoam is thin, glue the toothpicks to the underside of the wing instead.)



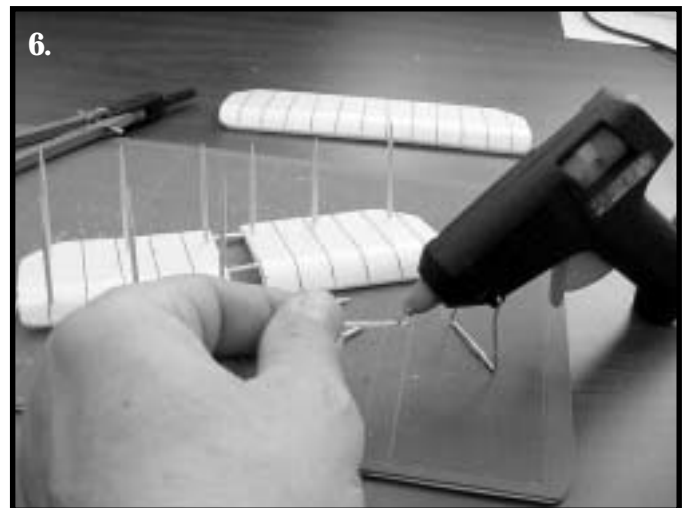
4. Make 12 spars by cutting toothpicks to a 2-inch (5-centimeter) length and sharpening the cut ends.



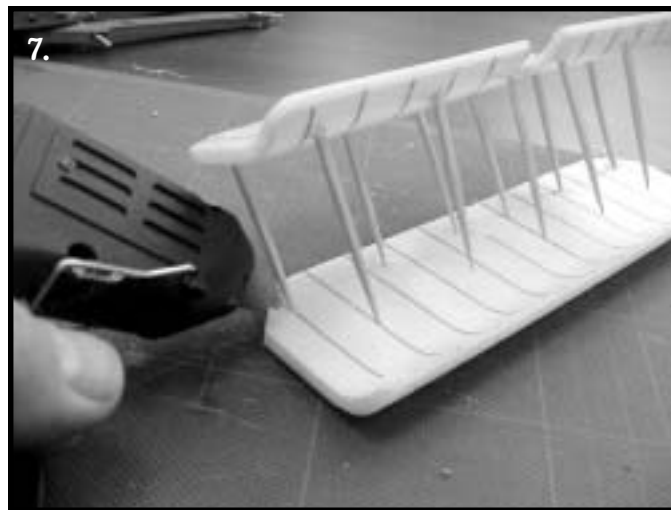
5. Use the wing template and a sharp toothpick to mark the holes for the spars on the top surface of the lower wing and bottom surface of the upper wing. Note that the front edges of the wings curve down. In this picture the upper wing in the back is upside down.



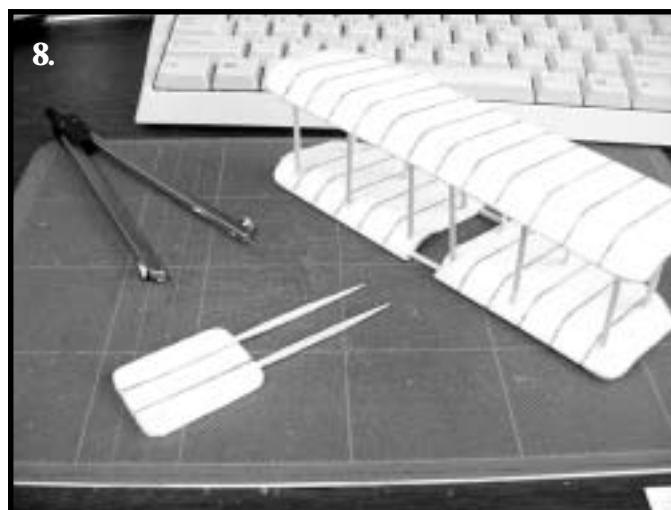
6. Dip toothpicks in glue and insert them in the spar holes now marked in the lower wing. Try not to push them all the way through the wing. Be sure they are standing up as straight as possible.



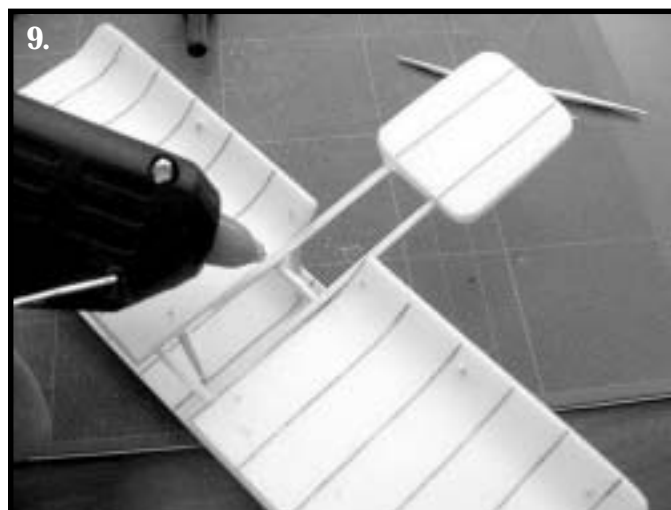
7. Now, with both the upper and lower wings and wings upside down (the edges should be curving up at this point), insert the back row of spars into the underside of the top wing. Use the marked holes as a general guide, but keep the spars straight and evenly spaced. Put a little glue on each to keep them in place as shown in the picture. Now join the front spars to the top wing, remembering to keep them straight and fasten them with dabs of glue. This takes some effort to get everything in the right place and is easier to do with two people.



8. Stick two toothpicks into the edge of the end of the elevator and add a dab of glue to hold them in place. (If the Styrofoam is thin, glue toothpicks to the underside of the elevator instead.)



9. Turn the glider over and glue the elevator assembly on either side of the opening in the lower wing as shown.



10. Turn the glider over again and insert a toothpick in the center of the left rib line as shown and add a bit of glue. Then insert the other end of the toothpick into the front edge of the upper wing and glue. Add another toothpick in the same way to the right rib line. (If the Styrofoam is thin, glue these to the underside of the upper wing instead.)



11. (Optional) Cut enough .6-inch (1.5-centimeter) toothpick pieces to stick into the back edge of each wing on the lines to simulate the ribs.
12. For display, the kite can be hung on a thread and strings can be added to be held by kneeling plastic toy soldiers. ADULTS: You may add figures by cutting, swapping, and gluing parts of plastic army soldiers. To obtain the desired poses, arms and legs can be removed and some from other soldiers glued in their place. Guns and helmets should be trimmed away using a hobby knife and the figure arms and legs can be shaped, swapped, or repositioned to fit and glued on. Five-minute epoxy works best for this. See steps 12 of the 1901 Glider instructions (pages 52 and 53) for more detailed illustrations.

